

PageMate®

Application Notes

Version 3.3-0

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Systemetrics, Inc.
153 Lexington Avenue
Cambridge, MA 02138 USA
Phone 617.868.8308
<http://www.pagemate.com>

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Introduction

This document is a supplement to the PageMate User's Guide.

Application Notes for PageMate® is a collection of technical notes, hints, kinks and operational recommendations for PageMate administrators. There is no particular order or implied importance based on the order of presentation in this document. It is less formal than the User's Guide and is intended to serve as a reference to help answer questions that have come up from time to time in the past, and will likely come up again among those who are responsible for managing the day-to-day operation of PageMate software.

We have tried to organize the notes collected here under subject headings that will make them easy to use as a reference. So you should, we hope, be able to scan the Table of Contents to see if there are any topics that interest you, check out the ones that ring bells, and ignore the rest.

Please note that information provided in this document may be specific to software versions and builds released on or after the publication date of this document. The PageMate software version to which this document applies appears on the front cover. The publication date of this document appears on the inside front cover.

If you have questions that are not answered here, please call or send e-mail to PageMate Technical Support at support@pagemate.com.

Using Modems with PageMate

Data modems (modulator-demodulators) are devices that convert digital data to analog signals for transmission over analog networks like the public switched telephone network (PSTN).

PageMate can dispatch text messages via both commercial and private paging systems and services. Messages submitted to commercial paging service providers are usually dispatched either using modems on the switched telephone network or using socket services on the public Internet. Messages submitted to private or customer-owned paging systems and services are usually dispatched either using dedicated serial lines or using socket services on a private LAN.

If you plan to use PageMate software to send messages to pagers on a commercial paging service via the switched telephone network, you will need to have at least one data modem, dedicated for paging use, connected to your PageMate server. Sites with requirements for high message volume or redundancy may use up to ten modems connected to a computer running PageMate software. If you are not using modems with PageMate, the information provided here does not apply to you.

The modems you use with PageMate need to be dedicated to paging use for two reasons.

- PageMate uses mechanisms for optimization and arbitration in modem allocation which assume that it has exclusive control of the modem ports. The arbitration software has no knowledge of any other applications that might be attempting to use these ports, and would be likely to conflict with or disrupt any other such use.
- Data communications systems maintained by paging service providers are based on specifications that were defined many years ago and are generally inconsistent with the default settings of modems and de facto standards for telecommunications today. In order to communicate successfully via a modem with a commercial paging service company, you need to set up the modem in a way that is unique to paging. Most paging service companies suggest that your

modem port be set up to send and receive data with 7-bit characters and even parity at 1200 baud with data compression and error correction disabled. In the absence of other specifications, PageMate will assume these values as defaults.

Something else we ought to mention is the matter of Teletype emulation. All commercial paging services in the Western world operate systems that assume Teletype (brand) teleprinter standards for data communication. Yes, this is something of a hold-over from years long past.

So why should we care? One good reason, and the only one that matters to PageMate, is that the reliability of transactions that PageMate makes on your behalf to paging services over the switched telephone network will be directly (but not solely) related to the faithfulness and accuracy with which your modems emulate the operation of a Teletype teleprinter. That faithfulness and accuracy, in turn, will be a function of the firmware in your modem's NVRAM. And it is in the interest of working with modems that live up to a high standard of this faithfulness and accuracy that there are only a few specific modems, three external and one internal, that we support for use with PageMate.

The three external modems, MultiTech MT1932ZDX, MT2834ZDXb and MT5634ZBA, are supported on all platforms. The internal modem, MultiTech MT5634ZPX-PCI, is supported on Windows platforms only. All four of these modems require NVRAM initialization for use with PageMate. External modems purchased from Systemetrics are shipped pre-initialized. Supported internal modems and external modems acquired from other sources can be initialized with a program available free of charge from Systemetrics Technical Support and installed together with PageMate Server on Windows platforms.

It is possible, of course, to use other brands and models of data modems with PageMate, but Systemetrics does not support operation with modems other than those we have listed. If you have compelling reasons to use other brands or models of modems with PageMate, you should know that you will need to make some changes to the default operating characteristics of most other modern modems. The default operating characteristics of most modern modems "off the shelf" or "out of the box" will not be suitable for Teletype emulation.

Default operating characteristics, those that are automatically in effect when a modem is powered up, are stored in NVRAM (non-volatile random access memory) in the modem. Capabilities to modify NVRAM parameters are provided by commands that can be issued to the modem through its serial port. Most modems support a basic set of commands that are common across brands and models, supplemented by additional commands that are unique to the manufacturer and model. You will need to be familiar with both the common set and the model-specific set of commands in order to modify NVRAM parameters in your modem. The complete set of commands that are supported by each brand

and model of modem should be defined in documentation provided by the modem manufacturer.

If you have compelling reasons to use an unsupported modem with PageMate, as a start, we suggest that you modify the NVRAM parameters in your modem to match as closely as possible the following default operating characteristics:

- Data compression disabled
- Verbose responses (results sent as words)
- “OK” response to +++
- Originate operation only (answer mode disabled)
- V.42 operation disabled
- Modem-initiated flow control disabled
- Computer-initiated flow control enabled
- ENQ/ACK pacing off
- Carrier detect follows carrier signal
- Modem ignores DTR signal
- Wait up to 3 seconds for dial tone
- Wait up to 60 seconds for carrier
- 100 ms spacing between tones in tone dialing

Finally, irrespective of what brand or model of modem you are using, we might offer a comment or two about the selection of data communication parameters that you use or specify for use with your modems. The first and most obvious one of these parameters is the speed or data communication rate. The question that usually arises here is, “What data rate (speed) should I use in communications with my paging service?” In most cases, the answer is 1200 baud. Secure in the knowledge that modems today can run much faster, you will probably protest, and you might even think that running at 9600 or 19,200 will mean greater throughput. In most cases, you will be wrong. Running at a higher speed will increase your error rate and mean little or nothing in terms of transaction time. The only caveat that we offer here is that it can benefit your transaction time to set your modem to operate at whatever speed your paging service provider will answer with by default, because this can avoid spending the time it takes your modem to do speed negotiation during call establishment.

But where do you set data communication parameters? There are three relevant parameters, including character data size, parity and data communication (baud) rate. You can set all three of these on a per-network basis through the PageMate Administrator GUI or through manually editing the networks.dat file in your PageMate Data directory. The PageMate Administrator GUI provides an interactive dialog that can be used to edit parameters in the networks.dat file, or

you can edit the file manually with your favorite text editor. But in the case of data communication rate, in particular, there is more to the story, and more than one place to be concerned about making this kind of change if you want to operate at any speed other than 1200 baud.

Some important things to know about setting or changing data communication parameters are these:

- ✓ In the absence of specification of Comm Parameters in networks.dat, the default will be 7E1200 (7-bit characters data size, even parity, and 1200 baud).
- ✓ Specifications for character data size and parity (*e.g.*, 7E or 8N) in Comm Parameters affect both the characteristics of the serial port on your computer and the characteristics of data that your modem will use in communication with the network.
- ✓ The specification for baud rate in Comm Parameters affects the characteristics of the serial port on your computer only. A specification for baud rate provided here will not, in general, have any effect on the data rate used in communication between your modem and your networks (paging service providers).
- ✓ To set or change the data transmission (baud) rate used in communication between your modem and the network, you must either specify a communications baud rate saved in your modem NVRAM or provide a Setup String specification in networks.dat records. Unless it is mandatory that you use different baud rates to work with different networks, we strongly urge and recommend that you select a single baud rate for all of your communications and avoid the use of setup string specifications. Higher baud rates do not equate to higher message throughput or productivity, and almost all paging networks will work at 1200 baud.

Using Sockets with PageMate

PageMate support for IP sockets provides an alternative to using modems on the switched telephone network to submit messages to commercial paging service providers.

PageMate provides capabilities to use IP (Internet Protocol) sockets to submit messages via the public Internet as an alternative to using modems on the switched telephone network. IP sockets can also be used on local area networks with private or customer-owned paging systems. Owing to characteristics of higher bandwidth and the elimination of the intricacies of call establishment and tear-down required with modems, sockets provide an attractive alternative to modems on the switched telephone network. A message transaction that requires 45 seconds to complete using modems can typically be accomplished in 2 or 3 seconds using sockets on the public Internet.

A popular feature supported by PageMate is the use of IP sockets as a primary delivery mechanism together with automatic fail-over to modems on the switched telephone network. If your Internet connection fails or service is lost, PageMate can automatically fail-over to using modems until service is restored.

For users who may be unfamiliar with IP sockets or their application in PageMate, this Application Note provides some brief background information about IP sockets, TCP ports and configuration parameters that are used with socket support in PageMate.

What's a Socket?

A socket is an endpoint used in network communications. An IP socket is defined by an IP address and a port number. A port is a logical address that serves to subset an IP address. Every IP address can have up to 65,535 port numbers (subset addresses). Computer applications, typically running on different systems, can communicate over IP by exchanging data through sockets.

There are two kinds of sockets, known as stream sockets and datagram sockets. Stream sockets transmit data in a continuous stream, without regard to record boundaries. Datagram sockets transmit data in discrete, bounded records. PageMate uses stream sockets.

Port Assignments

Ports are identified by decimal numbers in the range 1 through 65535. Some ports, commonly called "well known ports", are reserved for common and widely-used services, such as FTP, HTTP, Telnet and SMTP.

By convention, port numbers in the range 1 through 1023 are used for well-known ports. Port numbers in the range 1024 through 49151 are used for registered applications, and port numbers in the range 49152 through 65535 are reserved for dynamic and private port assignment. In Microsoft Windows environments, TCP/IP and Windows Socket services use a somewhat different scheme for assignment of port numbers above 1023. In this environment, port number 1024 is reserved, port numbers in the range 1025 through 5000 are dynamically assigned, and ports in the range 5001 through 65535 are available for private assignment.

IANA, the Internet Assigned Numbers Authority, assigns and publishes a listing of well-known port assignments. You can find the latest IANA listing of port assignments on their web site at <http://www.iana.org/assignments/port-numbers>. An understanding of port concepts is good to have under your belt, but unless you plan to support two-way messaging services, you might not be called upon to specify any network addresses or port numbers other than those that are defined for you by your paging service providers.

If you plan to support one-way messaging via sockets, you will need to specify target addresses for your outbound connections to paging services. These specifications are provided through records in networks.dat, as more fully described in Chapter 2 of the PageMate User's Guide.

If you plan to support two-way messaging, including support for message replies and responses from WCTP services, you may also need to specify a local network address and port number for inbound connections. If you intend to direct replies and responses to third-party addresses (via PageMate's reply-to parameter), you will not need to provide a port specification for inbound connections.

How PageMate uses Ports

PageMate provides capabilities to use Internet connections to submit both one-way and two-way messages to paging service providers and, optionally, to receive replies and responses from two-way messaging systems and services. These capabilities are implemented via TCP/IP using IP stream sockets.

Both PageMate Classic Server and PageMate Automated Messenger Server provide support for submitting one-way messages to pagers, PDAs and digital telephones via the Internet using TAP (Telocator Alphanumeric Protocol). TAP is a protocol that can be used to submit messages to paging service providers, systems and

encoders via direct connection (leased or dedicated lines), dial-up connection using modems and the switched telephone network, or via a network (either the public Internet or a private LAN) using IP sockets.

PageMate Automated Messenger Server provides support for submitting messages to and receiving replies from two-way pagers and other portable devices via the Internet using WCTP (Wireless Communication Transfer Protocol). If you plan to use socket connections to submit messages via either TAP or WCTP, you will need to specify a positive (non-zero) value for the `SOCKET_LIMIT` parameter in your Windows Registry or in your `pagemate_defaults.dat` file in UNIX and OpenVMS. This parameter specifies the maximum number of sockets that PageMate will be allowed to use at any one time. PageMate will support simultaneous use of up to ten (10) serial port devices, including modems on the switched telephone network, dedicated serial lines, and IP sockets.

Each end of an IP socket connection between PageMate and a message service provider must have a network address and port assignment. In client-server communications, one process acts as a client (the initiator of a service request) and another process acts as a server (the provider of a service).

When submitting either one-way or two-way messages to a paging service, PageMate acts as a client and your paging service provider's system acts as a server. For simplicity, we can refer to this as an outbound connection. To receive message replies and responses from a two-way service, a separate inbound connection is required. In this connection, PageMate acts as a server and the paging service provider's system acts as a client.

In programming client-server applications, it is conventional to let the operating system select the port that will be used on the client end of a connection. The reason for this is that applications generally will not or cannot know what ports are already in use, and allowing an application to specify a port poses a danger of conflicting with another socket assignment.

In most cases, you will not need to be concerned with specifying either a local network address or a local port for outbound connections. Exceptions to this rule can arise, however, if you are operating behind a firewall or if your PageMate Server has more than one network interface (and thereby more than one network address).

If you need to specify a local network address to select a network interface for an outbound connection, you can now provide a local network address as the 12th parameter in a `networks.dat` record. Additional information is provided in Chapter 2 of the PageMate User's Guide, and in `networks.dat` in the PageMate examples directory.

WCTP 2-Way Services

PageMate Automated Messenger (PAM) Server provides support for two-way messaging with selected protocols in conjunction with messages submitted via IP sockets to paging service providers. Messaging protocols that support two-way services include WCTP, SNPP, SMTP and OUCH. Two-way services allow a mobile message recipient to enter, on the receiving mobile device, a reply or response to a message. The paging service provider sends the reply or response either back to the system that submitted the original message or to an e-mail address that was specified with the original message. That, at least, is an unqualified description of how two-way services can work.

Qualifications to the description include things like not all paging service providers (commercial services that provide over-the-air transmission) support all protocols that are or can be used for two-way messaging, and some paging service providers may only support one-way messaging with protocols that are or can be used for two-way messaging.

Messages submitted to a two-way capable service via WCTP, SNPP, SMTP or OUCH can include a reply-to parameter that specifies an e-mail address for return of replies and responses. For more information about this, see the Application Note for [Two-Way Messaging](#), elsewhere in this document. WCTP also supports, as an alternative, returning replies and responses to your PageMate server, the system that submitted the original message. Support for this option is the topic of the rest of the discussion under this heading.

To provide WCTP support for return of replies and responses to a PAM Server, a second pair of sockets is required to allow the paging service to send a reply from the original message recipient back to PageMate. This transaction occurs sometime (from a few seconds to several hours) after an original message is sent to a subscriber. The configuration required to support this inbound connection is one in which the paging service provider's system acts as the client (the initiator of a transaction), while your PageMate system acts as the server.

To support this inbound operation, you must specify the network address and port to which you want your WCTP paging service to send replies. You provide this specification via the WCTP_PATH Registry parameter on a PAM Server. The specification that you provide via WCTP_PATH must include both a network address and a port number, delimited by colon. An example is "http://wctp.mydomain.com:7700/".

There are some important things to know about the specification and format of the string you provide via WCTP_PATH. These include:

- WCTP_PATH must specify a network address and port on the public Internet (i.e., an "outside" address). If your PAM Server is directly connected to the

public Internet, the network address you specify in `WCTP_PATH` will simply be the static IP address of your PAM Server system. If your PAM Server system is behind a firewall, however, `WCTP_PATH` must specify a network address and port that your firewall presents (on behalf of your PAM Server) the outside world.

- Your `WCTP_PATH` string value should begin with the transport protocol specification "`http://`" or with "`://`".
- Following the transport protocol specification, you must specify a network address, either as a domain name address or as a dotted decimal IP address (e.g., either `www.somedomain.com` or `123.45.67.89`)
- To the end of the network address, you must append a colon delimiter, a port number and a terminating slash. The port number should not be 80 or conflict with any TCP port used by any other application on your system. PAM Server provides and automatically runs an HTTP service to receive message replies at the address you specify via `WCTP_PATH`.
- PageMate provides (creates and manages) an http web server required to serve inbound transactions from WCTP message service providers. By default, PageMate will assume that the "inside address" that it will use for this service will be the address configured with the network interface hardware on your system (for systems that have a single network interface), and the port number will be the same as the port number specified in `WCTP_PATH`. If your PAM Server system is behind a firewall and if the local port on which you want PageMate to listen for WCTP replies is different from the port you specified in `WCTP_PATH`, you must provide an "inside" port specification via `WCTP_PORT1`. You do not need to specify an "inside" IP address via `WCTP_PORT` unless your system has more than one network interface.
- To summarize the relationship between `WCTP_PATH` and `WCTP_PORT` parameters in configurations behind firewalls, it might help to remember that `WCTP_PATH` is an outside network address and `WCTP_PORT` is an inside address. You may, in fact, use `WCTP_OUTSIDE_PATH` as an alias for `WCTP_PATH` in the Registry, and use `WCTP_INSIDE_PATH` as a alias for `WCTP_PORT`. You can use either name, but if `WCTP_PATH` is defined, it will take precedence over `WCTP_OUTSIDE_PATH`, and `WCTP_PORT`, if defined, will take precedence over `WCTP_INSIDE_PATH`.
- If your PAM Server system is behind a firewall, your firewall must be set up to permit outbound HTTP messages to pass from your PAM Server to your paging service provider, and inbound HTTP messages to pass from your paging service provider to the WCTP port on your PAM Server system.

NOTE 2: USING SOCKETS WITH PAGEMATE

Using Text-to-Speech with PAM

PageMate Automated Messenger (PAM) Server supports voice delivery of messages via text-to-speech technology.

PageMate Automated Messenger Server supports both one-way and two-way messaging, and also provides optional support for enunciation of messages via telephone, plant radio and in-plant public address systems. The Voice Connector for PAM Server uses text-to-speech technology to convert text messages to spoken English. Electrical interface to telephone, plant radio and public address systems is provided by Dialogic telephony interface hardware. Device driver support for Dialogic hardware is provided by the Dialogic Standard Runtime Library (SRL).

If you will be installing a Dialogic telephony interface (e.g., D/4PCIUF) in a system that has not had a prior installation of the Dialogic SRL, it is suggested that you install the SRL (drivers software) before you install the D/4PCIUF (hardware). The reason for this is simply to avoid having to deal with the Microsoft Found New Hardware Wizard. You do not want the Found New Hardware Wizard to run until after you have installed the SRL.

If, however, you have already installed the telephony interface card and you find yourself confronted with the Found New Hardware Wizard asking if you would like to

- a) Install the software automatically (Recommended), or
- b) Install from a list or specific location (Advanced)

the correct answer is "Cancel" (Thank you, Wizard, for being so helpful. Now please go away.)

Installing the SRL

The Dialogic SRL is distributed as a WinZip archive. The first thing you will want to do with it is to unpack it, preserving directory names, into a temporary directory on a hard drive. It is suggested that you create a directory for this purpose. After

the installation is complete, you can delete the temporary directory and all of its files and subdirectories.

After unpacking the archive, run setup.exe (in the temporary directory) and follow the directions on the screen. If the Found New Hardware Wizard appears at any time during installation of the SRL, cancel it.

During installation of the SRL, Windows (which really can't stop trying to be helpful) may announce, "The driver you are installing for Intel Dialogic has not been properly signed... Do you still want to install this driver software?" The correct answer, of course, is "Yes".

When installation of the Dialogic SRL is complete, shut down the system and install the D/4PCIUF telephony interface card. Then reboot. When you reboot and are next confronted with the Found New Hardware Wizard, select the option to install from a list or specific location, and point the Wizard to the Dialogic drivers directory. The SRL will install an application known as the Dialogic Configuration Manager (DCM), which you will need to run configure the D/4PCIUF. It will also create a Windows Service known as the Intel Dialogic product System Service. This service must be running in order to use the telephony interface board. It can be started manually using DCM, or you can set it, via the Windows Services applet, to autostart when the system is booted.

One more item of curiosity that you will need to know is that the SRL will assign device names of the form dxxxBnCm for each telephony line in a 4-line D/4PCIUF. In these names, n is the board number (starting with 1 for the first board) and m is the line number (1 through 4).

You are now (finally) ready to install PageMate Server Version 3.1. For guidance about this vitally-important part of the journey, we refer you to the PageMate V3.1 User's Guide. When you're done, come back here to wrap up.

Wrapping Up

There is just one more thing we need you to check after you have installed PageMate Server. When you install the PageMate Voice Connector, the installation procedure should provide a file named DECTalk.dll either in your Windows\System32 directory or (more likely) in your PageMate\Lib directory. You really need it to be in your Windows\System32 directory, so if it isn't there already, copy it to Windows\System32 before you start the PageMate Server service.

Two-Way Messaging

PageMate provides support for two-way messaging in conjunction with messages submitted for delivery via WCTP, SNPP, SMTP and OUCH protocols.

WCTP is an electronic messaging protocol that was designed for the express purpose of supporting two-way text messaging. The first WCTP specification and early implementations provided support for replies and responses associated with a message to be sent back to the system that submitted the original message to the paging service provider (*e.g.*, a PAM Server). This functionality is still supported, and you can find more information about support for this option in the description of [WCTP 2-Way Services](#) under the Application Note entitled [Using Sockets with PageMate](#) elsewhere in this document.

Since the original release of WCTP in 1999, the demand for SMS (short message service) and two-way text messaging support for cell phones has led many paging service providers to begin supporting services that

- 1) accept text messages submitted under a variety of protocols, including WCTP, SNPP, SMTP and OUCH;
- 2) convert the messages to SMS for outbound delivery to cell phones and similar SMS-capable devices;
- 3) accept from a mobile recipient replies and responses associated with an original outbound SMS message, and
- 4) return replies and responses to an e-mail address that was specified with the original outbound message.

PageMate Automated Messenger Server Version 3.2 and later provides support for specifying a reply-to parameter in conjunction with messages submitted to a WCTP, SNPP, SMTP or OUCH network. The reply-to parameter is passed to the paging service provider as the e-mail address that the provider should use to deliver replies and responses from the mobile recipient.

A few important points and good things to know about this functionality include:

- ✓ PageMate will accept specifications of arbitrary reply-to addresses, up to 127 characters in length, with any message submitted by a client being served by a PAM (PageMate Automated Messenger) Server, V3.2 or later. Subject to constraints imposed by the protocol, PageMate will pass that reply-to address to the paging service provider when the message is served by any of the supported two-way protocols, including WCTP, SNPP, SMTP and OUCH.
- ✓ Paging service providers may or may not accept or agree to return replies to a specified reply-to address. The fact that a protocol allows such a specification, together with the fact that we provide such a specification, does not guarantee that a paging service provider will agree to honor it.
- ✓ Message send dialogs in PageMate V3.2 (or later) native GUI clients will provide a field for specification of an arbitrary reply-to address if and only if reply-to functionality has been enabled on the PAM Server that will serve the message. This functionality is disabled by default. It can be enabled by setting the Registry parameter REPLYTO_ENABLE to TRUE in the PageMate Server Registry hive.
- ✓ In PageMate V3.2 (and later), two new Client API functions, `pagemate_send_reply()` and `pagemate_direct_reply()`, provide support for submitting messages with a reply-to specification from application programs. Any PageMate Client application program can call the new API functions, irrespective of whether the Client is served by a PageMate Classic or PAM Server, but reply-to specifications will only be honored by PAM Servers.
- ✓ REPLYTO_ENABLE affects displays in client GUI dialogs only. It has no effect on API functionality.
- ✓ The syntax of PageMate API functions supported in prior versions of PageMate has not changed. PageMate V3.2 is backward compatible with V3.0 and V3.1.
- ✓ To take advantage of new reply-to functionality, both PageMate Client and PageMate Server must be Version 3.2-0 or later. A PageMate V3.2 Client requires a V3.2 Server, but a V3.2 Server will serve any same or earlier V3 Client (*e.g.*, V3.0, V3.1 or V3.2).

Exception Condition Handling

PageMate provides support for notification, fail-over and automated response for a variety of exception conditions and events that can threaten reliable delivery of messages.

There are a variety of potential problems and conditions that can prevent messages from being delivered to their intended recipients. The PIN or recipient address associated with a message may be invalid. A paging service provider can, for reasons of its own, refuse to accept a message. Problems with modems, routers and network connectivity can cause data communications to fail. Some problems or conditions may affect the delivery of an individual message only, while others may have more far-reaching effects.

We would like there to be a way that PageMate administrators, the people responsible for managing PageMate operations, can be notified of these conditions and events. We would also like administrators to be able to customize mechanisms for notification for different levels of problem severity. We would also like PageMate to provide support for automatic fail-over mechanisms, where possible, to allow paging service to continue without interruption while problems with equipment, networks or services are being resolved.

Both the characteristics of a problem and the degree of redundancy provided in a PageMate configuration may affect the level of urgency required for dealing with exception conditions and events. PageMate accepts as part of its responsibility the job of providing options for notification and reporting of exception conditions and events, both historically and dynamically as they arise or occur. The software also provides options for automatic fail-over and redundancy to minimize the effects of equipment or network failures wherever possible.

With respect to providing notification and reporting of exception conditions and events, two principal mechanisms are:

- ✓ Adding an entry to a log file in the PageMate Logs directory; and
- ✓ Sending an e-mail message to a site-specific administrator e-mail address.

In addition to these mechanisms, PageMate provides an option to execute site-specific scripts and command procedures for some conditions and events, providing a mechanism that you can use, if desired, to design your own site-specific notification. In multi-server configurations, PageMate Server can automatically shut down and force fail-over to an alternate server.

The occurrence and detection of an exception condition or event is always reflected in a time-stamped message written to a PageMate log file. Additional actions, including options for dynamic notification and automated response, may or may not be performed based on site-specific configuration parameters. In Windows environments, configuration parameters are defined in the Registry under HKLM\SOFTWARE\Systemetrics\PageMate\Server. In Unix/Linux and OpenVMS environments, configuration parameters are provided in a file named `pagemate_defaults.dat`.

Options for dynamic notification and automated response for several specific conditions and events are described separately in paragraphs below. Support for detection, notification and automated response for these conditions and events is a part of self-monitoring functionality built into PageMate. Support for a companion capability to monitor PageMate's message queue is described separately in Application Note 6 in this document.

For each of the conditions and events described below, PageMate supports an option to provide e-mail notification to the PageMate administrator. To use this feature, the PageMate Electronic Mail Connector must be licensed on the PageMate Server, and configuration prerequisites for e-mail service must be satisfied. On Windows platforms, this can include ensuring that configuration parameters `SMTP_FQDN` and `SMTP_SENDER` are defined. On all platforms, configuration parameters `ADMIN_EMAIL` and `ADMIN_NOTIFY` are used to specify an administrator e-mail address and the categories of conditions and events for which administrator e-mail should be sent. Configuration parameters are defined and described individually in Table 2-3 (Chapter 2) in the PageMate User's Guide.

Message Delivery Failure

PageMate's attempts to deliver a message to a paging service provider or system can fail for a variety of reasons. Problems with network connectivity may prevent PageMate from contacting a paging service provider or system. The PIN or addressee associated with a message may be invalid. A paging service provider or system may refuse to accept a message for reasons of its own.

PageMate's response to a message delivery failure can include sending an e-mail notification to the PageMate administrator, and may also include re-attempting delivery through an alternate connection or network path. Before either of these

things are done, if the original delivery attempt failed because PageMate was unable to contact or connect to the paging service or system, or if connection was lost or interrupted after being once established, PageMate will make multiple attempts to restart or re-establish the original connection. If these things fail, e-mail notification and fail-over options come into play.

ADMIN_NOTIFY is a configuration parameter that specifies, in a comma-delimited list, one or more of several conditions and events for which e-mail notification should be provided. If MESSAGE is specified as one of the conditions and events in ADMIN_NOTIFY, and provided that other prerequisites for e-mail service are satisfied, PageMate will send an e-mail notification describing the message delivery failure to the e-mail address specified in ADMIN_EMAIL.

If the message delivery failure was the result of a network or data communications problem, and if a fail-over network (path to a paging service provider or system) is defined for the original delivery network, PageMate will re-submit the original message for attempted delivery on the fail-over network. Messages that fail delivery for reasons other than connectivity or data communications problems will not fail-over to alternate networks.

Serial Port Failure

PageMate submits messages to paging service providers and systems, referred to in PageMate-speak as networks, through serial data communications ports. Serial ports may be RS232 serial line connections (*e.g.*, Windows COM ports) or IP socket connections on a LAN or on the public Internet.

Data communications problems that result in connection failures on serial ports are tracked by PageMate, and a consecutive failure count is maintained for each port. For physical serial ports (RS232 serial lines), the consecutive failure count associated with each port is compared against a site-specific threshold value set via the NO_RESPONSE_LIMIT configuration parameter. If the consecutive failure count for a physical serial port reaches the threshold value, PageMate will automatically set the port to OFFLINE status, making it ineligible for use in future message dispatch operations. Serial ports can be reset to ONLINE status in either one of two ways:

- ✓ Serial ports can be manually set to ONLINE, OFFLINE or DISABLED status through operator action via the PageMate Administrator GUI.
- ✓ All serial ports, unless they have been marked DISABLED, are automatically set to ONLINE status when PageMate Server is started.

PageMate supports an option to notify the PageMate administrator via e-mail when a port is marked OFFLINE as a result of consecutive failures. If PORTS is

specified as one of the conditions and events in ADMIN_NOTIFY, and provided that other prerequisites for e-mail service are satisfied, PageMate will send an e-mail notification describing the OFFLINE action to the e-mail address specified in ADMIN_EMAIL.

In addition to e-mail notification, PageMate supports an option to execute a site-specific program, script or command procedure when a port is marked OFFLINE as a result of consecutive failures. The PORT_ALERT configuration parameter, if defined with a value other than NULL, specifies the fully-qualified path to a site-specific program, script or command procedure to be run when a physical serial port is marked OFFLINE.

Connection failures associated with IP network serial ports (IP socket connections on a LAN or on the public Internet) are tracked and counted by PageMate as failures against the paging service provider or system to which a connection is being attempted (rather than being counted as a failure against the port). Connection failures associated with IP serial ports are reported to the PageMate log file, but IP serial ports are never marked OFFLINE as a result of consecutive failures. PageMate provides support for failover of IP serial ports, but does not provide e-mail notification based on IP serial port connection failures.

Threads Blocked or Hung

PageMate operates a multi-threaded Queue Server that dispatches message batches in independent threads of execution. Message threads operate independently, but the number of threads that can be executing simultaneously is limited to ten, so message threads are a vital and limited resource. If a message thread were to become blocked or hung, the number of threads available to serve other messages would be reduced. Most PageMate operations function under control of time-out parameters that will abort any operation that does not complete within a reasonable period of time. Although extremely rare, it is not impossible for threads of execution to become blocked or hung for extended periods of time. PageMate's Queue Server, therefore, continuously monitors thread execution. If any message thread fails to complete execution in a reasonable period of time, the Queue Server provides a variety of mechanisms for notification and automated response and recovery, including

- ✓ notice to the PageMate Queue Server log file;
- ✓ e-mail notice to the PageMate administrator;
- ✓ execution of a site-specific script or command procedure;
- ✓ termination of the network connection associated with a blocked or hung IP service thread; and

- ✓ shutdown or restart of the PageMate Server application.

Thread service notification and automated response is controlled by an assortment of site-specific configuration parameters. `SERVICE_AGE_WARNING` specifies a thread age threshold for notifications to the log file and e-mail notice to the PageMate administrator. `SERVICE_AGE_LIMIT` specifies a thread age threshold for execution of a site-specific script or command procedure, termination of IP network connections, and shutdown or restart of the PageMate Server application. The effective threshold value for each of these actions will vary depending on the service type (dial-up, direct-connect or IP socket) of the associated thread.

If you need to understand more about exactly how site-specific parameter values are applied in thread age monitoring and automated response, hang in here for a few more paragraphs. If for now you only care about the fact that this functionality is available, you can skip ahead to PageMate Log Files.

`SERVICE_AGE_WARNING` is an integer number of minutes that can be used to trigger notifications about service threads that have aged beyond the value it specifies. `SERVICE_AGE_WARNING` has a default value of ten and can be defined as any integer value between five and sixty. The *effective* value of `SERVICE_AGE_WARNING` will be a fraction of the specified value, based on the service type of the associated thread. For dial-up threads (modems on the switched telephone network), the effective value will be equal to the specified value. For direct-connect threads (persistent connections to paging systems, encoders or services), the effective value will be the specific value divided by five. For IP socket threads, the effective value will be the specific value divided by ten.

Notices to the PageMate Queue Server log file (`pagequeue.log`) will begin being written at one-minute intervals as soon as any thread of execution ages beyond its effective service warning threshold. If it has been requested, e-mail notification to the PageMate administrator will be sent as soon as any thread ages beyond twice its effective service warning threshold, and will be repeated once per hour until the thread terminates. Prerequisites for e-mail notification of service age warnings include that an e-mail address must have been specified via `ADMIN_EMAIL` and `ADMIN_NOTIFY` must include the specification `THREAD`. `ADMIN_NOTIFY` specifies a list of events or condition categories for which e-mail notification should be sent to the PageMate administrator.

`SERVICE_AGE_LIMIT` is an integer number of minutes that can be used to trigger automated response for service threads that have aged beyond the value it specifies. `SERVICE_AGE_LIMIT` has a default value of 20 and can be defined as any integer value between 5 and 120. As with `SERVICE_AGE_WARNING`, the effective value of `SERVICE_AGE_LIMIT` will be a fraction of the specified value, based on the service type of the associated thread. For dial-up threads, the effective value will be equal to the specified value. For direct-connect threads, the

effective value will be the specific value divided by five. For IP socket threads, the effective value will be the specific value divided by ten.

The actions, if any, that will be taken when a thread ages beyond its effective service age limit will depend on a variety of site-specific configuration parameters. If a site-specific script or command procedure has been specified via `SERVICE_AGE_COMMAND`, it will be run once only for each thread that ages beyond its effective service age limit. If `SERVICE_AGE_CLOSE` has been enabled and if the associated thread is an IP socket service thread, PageMate will close the socket associated with the thread when the thread ages to twice its effective service age limit. For dial-up and direct-connect service threads, and for IP socket service threads in the absence of `SERVICE_AGE_CLOSE`, PageMate will either shutdown or restart when the thread ages to twice its effective service age limit if `SERVICE_AGE_SHUTDOWN` or `SERVICE_AGE_RESTART` has been specified. If both have been specified, `SERVICE_AGE_RESTART` will take precedence. The only difference between `SERVICE_AGE_SHUTDOWN` and `SERVICE_AGE_RESTART`, of course, is that `SERVICE_AGE_SHUTDOWN` does not restart after shutting down.

PageMate Log Files

This topic, PageMate Log Files, and the next, Network Fail-Over, provide additional information and discussion about a couple of things that have been mentioned earlier, but may (for some readers) deserve further explanation.

PageMate veterans know that PageMate Server can create a variety of log files in the PageMate Logs directory. Under normal conditions, if an exception condition is detected or an error occurs during message processing, a brief description of the condition or event will be appended to a file, most often the file named `pageque.log` (in Windows) or `pageqsrsv.log` (in Unix and OpenVMS), in the logs directory. But there may be other log files, as well, and when debug logging is enabled, there will most likely be many other files. A few remarks about PageMate operation and architecture may provide useful insight about logging operations.

PageMate is a queued message delivery agent. In concept, it operates in a manner similar to a print queue that can serve up to ten printers simultaneously. For its part, PageMate can serve up to ten independent threads of execution that can be simultaneously dispatching messages to different systems or services operating over different ports. A port, in PageMate terminology, is any serial line, device or network connection that can be used to connect to a local or remote paging system or service, including plant radios and analog connections for voice message delivery over the switched telephone network.

Because there can be a variety of program images and up to ten separate threads of execution running simultaneously, and because we want to be able to track and

collect together all of the messages associated with each program or thread of execution, a separate log file will be created, if and as necessary, for each. Under normal conditions, there will be few, if any, entries written to log files, as PageMate quietly goes about its business dispatching messages. But there may be times when, for purposes of problem analysis and resolution, we want to track and record everything that PageMate is doing.

There is a special debug logging option which, when enabled, will cause PageMate to write to log files detailed trace information about everything that it does. Debug logging creates separate log files for each message or message batch that is dispatched by the PageMate Queue Server. Debug logging is a principal and valuable way to collect information for tracing operation and resolving problems in conjunction with PageMate Technical Support. More information about PageMate log files and debug logging can be found in the Support section of the website at www.pagemate.com

Network Fail-Over

Network fail-over is a capability that allows messages that fail delivery to a paging service provider or system due to hardware, configuration or network connectivity problems to be automatically requeued for delivery using an alternate path or method of delivery. If you have more than one method of submitting or delivering messages to a paging service provider, you can use automatic network fail-over to attempt recovery from problems such as these:

- ✓ You tried to submit a message using a modem connection on the switched telephone network, but the modem was dead or misconfigured, PageMate was unable to initialize the serial port, or the paging service did not respond to PageMate's handshake prompt after carrier was established. You have an alternate method of connection that you would like PageMate to try, such as a different phone number or a socket connection.
- ✓ Your default method of submitting messages to your paging service provider is via socket connection on the Internet, but your Internet service is down or the service provider is not responding to socket connect requests. You would like PageMate to try submitting the message via a modem connection on the switched telephone network.

Automatic network fail-over does not normally requeue messages that are rejected by a paging service provider for reasons of policy. Paging protocols provide a mechanism known as negative acknowledgment that allows a paging service provider to refuse to accept a message for reasons of policy, such as the recipient PIN (addressee) is invalid, the message exceeds that maximum message length supported for the recipient device or account, or the content of the message violates a rule or policy of the provider. Messages that are negatively acknowledged

are not requeued because trying again to submit the same message to the same recipient PIN is unlikely to have a different outcome. You had no problem communicating with your paging service provider, there were no data connectivity or transmission errors, you asked the service provider to accept a message for a listed subscriber, they refused, and the game is over.

The option to submit messages to a paging service provider via the Internet has brought new opportunities and new challenges to the game. Messages can be submitted much more quickly via TCP/IP sockets as compared to using modems on the switched telephone network. One consequence is that it is easier to overload the message queue at a paging service provider. It is also easier to swamp a pager or cell phone with messages generated by an automated system (*e.g.*, a network monitor or other application that might generate several hundred messages per minute).

Some paging service providers are now negatively acknowledging messages submitted via WCTP for policy reasons based on message volume. So it is now possible that a paging service provider might reject a message submitted via WCTP, but accept the same message for the same recipient if the message were submitted via a modem on the switched telephone network.

PageMate Automated Messenger Server for Windows provides an option to enable automatic network fail-over for WCTP messages that are negatively acknowledged by a paging service provider. You can enable this option via the `WCTP_NAK_FAILOVER` configuration parameter in PAM Server. When `WCTP_NAK_FAILOVER` is enabled, any message that is negatively acknowledged by a WCTP paging service provider will be automatically requeued on the fail-over network, if any, defined for the provider. PageMate will make no distinction based on the service provider's reason for rejecting the original message submission. A message that is rejected by reason of invalid PIN will be requeued the same as a one rejected by reason of message volume or any other policy. `WCTP_NAK_FAILOVER` is not supported in PageMate Classic Server because WCTP is not supported in Classic Server.

Queue Monitoring

PageMate provides capabilities for monitoring the length of the message queue and providing notification if message queue length exceeds site-specific thresholds.

PageMate maintains a multi-threaded message queue, conceptually similar to a print queue that can serve up to ten printers simultaneously. Instead of serving files to printers, the PageMate Queue Server dispatches messages and message batches to paging service providers and electronic messaging systems and devices, serving messages to up to ten serial lines and network ports simultaneously. The PageMate Queue Server maintains a central message queue from which it selects and dispatches messages in message priority order.

The PageMate Queue Server monitors the length of the message queue (the number of messages pending delivery in the queue), compares queue length to site-specific thresholds, and can provide notification or take directed action if the length of the queue exceeds either of two site-specific thresholds. A warning threshold can be defined to provide notification or early warning of queue length growing beyond a normally expected size. A limit threshold can be defined to provide emergency notification or take directed action. At either threshold, PageMate can be directed to take one or more of three actions:

1. Send a message to a specified e-mail address, providing notice of the queue length and PageMate server name;
2. Execute a site-specific script or command procedure; and/or
3. Shutdown or restart the PageMate Server application.

Threshold Parameters

The `PQW_THRESHOLD` site-specific parameter specifies the number of messages pending delivery that will trigger a queue length warning event, and the `PQL_THRESHOLD` parameter specifies the number of messages that will trigger

a queue length limit event. If either parameter is zero, as both are by default, monitoring and notification for the corresponding event is disabled.

The `PQW_ACTION` site-specific parameter specifies one or more actions to be taken if and when the number of messages pending delivery exceeds `PQW_THRESHOLD`. Similarly, `PQL_ACTION` specifies one or more actions to be taken if and when the number of messages pending delivery exceeds `PQL_THRESHOLD`. Both `PQW_ACTION` and `PQL_ACTION` can be comma-delimited lists comprised of one or more of the following:

- The word `EMAIL`, followed by an equal sign and a single e-mail address, e.g. `EMAIL=bsmith@mycompany.com`
- The token `EXE`, followed by an equal sign and a fully-qualified path to an executable script or program, e.g. `EXE=C:\scripts\notice.exe`
- Either one of the words `SHUTDOWN` or `RESTART`.

Each word or token can occur no more than once in a `PQW_ACTION` or `PQL_ACTION` specification. The value specified with `EMAIL` must be a single e-mail address (not a distribution list). The value specified with `EXE` must be a single filename. If `SHUTDOWN` is specified, PageMate Server will shutdown when the action is triggered. If `RESTART` is specified, PageMate server will shut down and then restart approximately 30 seconds after shutting down.

In addition to `THRESHOLD` and `ACTION` parameters, warning and limit thresholds have associated `INTERVAL` parameters, `PQW_INTERVAL` and `PQL_INTERVAL`. Each `INTERVAL` parameter specifies the interval, expressed in minutes, at which the corresponding event will be triggered while the queue length remains at or above the threshold. The default value for both `INTERVAL` parameters is 10 (ten minutes).

Queue limit notification takes precedence over queue warning notification. If the number of messages pending delivery in the PageMate message queue exceeds `PQL_THRESHOLD`, the only actions taken will be those specified via `PQL_ACTION`. `PQW_THRESHOLD` and `PQW_ACTION` will, in this case, be ignored. Either `PQW_THRESHOLD` or `PQL_THRESHOLD` may be specified without the other, but if both are specified, the value of `PQL_THRESHOLD` should be greater than `PQW_THRESHOLD`.

Finally, on Windows platforms, PageMate V3.3 supports two electronic mail services. The `EMAIL_SERVICE` site-specific parameter can be used to select between `GLOBAL` and `LOCAL` SMTP services. `GLOBAL`, the default service, provides functionality that is new in V3.3 as further described in the next Application Note and in the PageMate User's Guide.

Electronic Mail

PageMate's role and purpose is all about reliable delivery of time-critical messages. Electronic mail has a limited but important role in the service of this purpose.

Simple Mail Transfer Protocol (SMTP), otherwise affectionately known as RFC 2821, is the specification upon which electronic mail services are based. Electronic mail on the public Internet operates as a store-and-forward technology which, in simple terms, means that when a message is submitted, it is temporarily stored and then forwarded from one program or computer to another until it finds its way to a program running on the computer that can deliver it to the recipient(s) specified in headers associated with the message. In SMTP-speak, the programs and computers that handle the message along the way are called agents.

In a few moments (or paragraphs) we will have more to say about the functions performed by different SMTP agents, but first, a few comments about the kinds of things that e-mail can do in and for PageMate.

E-mail is a fantastic technology which, in consideration of the assignment it has been given, is incredibly robust. But it is not always timely, and it does not provide any guarantee of delivery. Most e-mail messages that circuit the public Internet arrive at their intended destinations within a few minutes of being submitted, but some take hours, and a few never arrive at all.

Protocols like TAP, WCTP, SNPP and others commonly used for paging, in contrast to SMTP, are delivered via direct connection from a submitting (source) system to the system that can affect ultimate delivery. When a message is submitted to PageMate for delivery via one of these protocols, the PageMate Server makes a direct connection to the system that will accomplish ultimate delivery, transmits the message to the destination server, and obtains a receipt from the destination server confirming that the destination server has inspected the message, verified the validity of the message and its intended recipient, and agreed to deliver the message.

Despite its limitations in timeliness and delivery, e-mail can contribute in some important ways to PageMate's overall goal of providing robust and reliable

message delivery. One of the ways that electronic mail can serve the broad goal of helping to ensure reliable message delivery is by serving as a backup or fail-over method for message delivery when delivery by other means or protocols fails. When a PageMate subscriber catalog record includes a specification for e-mail address, and provided that `FAILOVER_EMAIL` is enabled, messages that have exhausted other options for delivery via more direct methods can fail over to e-mail.

Another way that e-mail can be useful is in providing notice to PageMate administrators of problems or exception conditions that may arise in software operation or in conjunction with the operation of modems and network connections to paging service providers. PageMate's `ADMIN_EMAIL` site-specific parameter can be used to specify one or more subscribers or electronic mail addresses to which notifications of operational problems with PageMate software and facilities can be sent. Examples of this use of e-mail include notifications of message delivery failures, modem equipment failures, and message queue length in excess of threshold (as described elsewhere in this document under Queue Monitoring).

Finally, electronic mail can, of course, be used as a primary delivery mechanism for one-way messages that don't require the guarantees of traditional paging protocols.

PageMate Version 3.3 on Windows provides significant new functionality for electronic mail service in comparison to earlier versions. To provide background for a description of this new functionality, it will help to briefly review the functions performed by different SMTP agents.

SMTP Agents

An SMTP message begins its life with a computer program known in SMTP-speak as a Message User Agent (MUA). Microsoft Outlook is an example of a Message User Agent. An MUA hands the message off to a Message Transfer Agent (MTA). Microsoft Exchange is an example of an MTA. MTAs store and forward the message between and among themselves as the message is routed through the Internet from one domain to another as it winds its way to the MTA that can finally pass the message to a Message Delivery Agent (MDA) that will deposit it in a user's mailbox where it can be retrieved by another MUA.

In early versions, PageMate's Electronic Mail Connector served as a Message User Agent, operating on Windows in conjunction with Exchange (a Message Transfer Agent). The principal responsibility of an MTA is to figure out how to route a message to (or at least toward) its destination. In later versions, including Version 3.2, PageMate supported an option when operating within a corporate LAN to bypass Exchange and deliver a message directly to a recipient's mailbox. To distinguish this method of operation from the one that used Exchange as an intermediate MTA, the local LAN delivery method was called LOCAL mode,

while the method that depended on using Exchange as an intermediate MTA was called GLOBAL mode. With a few exceptions, GLOBAL mode was required to route messages beyond the local LAN. One exception is provided when an SMTP gateway service operating within the LAN provides MTA routing functionality for messages that need to jump the fence and get out onto the open road of the Internet highway.

PageMate's GLOBAL mode of operation depended not only on Exchange, but also on the functionality of an API library known as CMC (Common Mail Calls), distributed with Exchange. Both Exchange and CMC were frustrating, so we shed no tears when Microsoft decided that continuing to support CMC was an untenable proposition.

New GLOBAL Mode Functionality in PageMate V3.3 and Later

PageMate Version 3.3 replaces GLOBAL mode with an SMTP agent that can serve as both an MUA and an MTA, can route messages beyond a corporate LAN to any arbitrary e-mail address on the public Internet, and can be extended to support enhanced or extended SMTP (ESMTP), including SMTP Authentication.

GLOBAL mode SMTP functionality that is new in PageMate V3.3 plays alongside and without disrupting functionality provided in LOCAL mode in earlier versions. The first and most important thing to know is that new MTA functionality is provided in PageMate V3.3 through a network (in networks.dat) named MAIL. If a network named MAIL is defined in the networks catalog, its Network Access Number will be forced to be MAIL, a reserved name that tells PageMate that when processing any message addressed for delivery via this network, it should resolve the recipient e-mail address (*e.g.*, john.doe@somecompany.com) provided in the subscriber catalog record to a delivery address (routing) on the public Internet, and dispatch the message to the SMTP server (MTA and/or MDA) at this address.

PageMate can dispatch messages for delivery via e-mail for a variety of purposes, including

- ✓ SMTP as primary delivery mechanism for a message;
- ✓ SMTP as secondary delivery mechanism for a message that failed delivery via some other primary protocol (*e.g.*, SNPP, WCTP or TAP); and
- ✓ SMTP for delivery to support and administrative personnel of operational exception condition messages.

If we want to allow any and all of these messages to be routed via the public Internet to arbitrary e-mail addresses, we need to either

- a) provide a way that they can be addressed to subscriber names that reference network MAIL, or
- b) provide a local SMTP gateway through which all e-mail will be routed.

The way this is accomplished in PageMate Version 3.3 is:

- a) a PageMate subscriber catalog record that specifies primary delivery via a non-SMTP network can, for fail-over purposes, specify via its e-mail address field a subscriber name that references (via its catalog record) an SMTP network;
- b) PageMate's ADMIN_EMAIL site-specific parameter can now specify one or more subscriber names and/or explicit e-mail destination addresses (in any combination) in a comma-delimited list up to 255 characters in length; and
- c) If SMTP_GATEWAY is defined, PageMate will submit all SMTP messages, irrespective of mode and network, to the network address provided with SMTP_GATEWAY.

In the absence of an SMTP_GATEWAY specification, any message that is dispatched for SMTP delivery via network MAIL will be routed by PageMate acting as an MTA. Any message that is dispatched for SMTP delivery by any other means will be routed by PageMate acting as an MUA or local SMTP client.

It might be useful here to provide an example. Let's say that you have a Verizon mobile phone with (fictitious) phone number 800-123-4567, and you want PageMate to be able to send text messages via SMTP to this mobile device. Absent an SMTP gateway, how would you define a minimal subscriber catalog record to do this? The answer is as shown immediately below.

The screenshot shows a 'PageMate Subscriber' dialog box with the following fields and values:

- Subscriber Name: DROID
- User Registration Name: Danny Droid
- Employee Number: (empty)
- Company Department: (empty)
- Pager Network: MAIL
- Type: Text
- PIN: (empty)
- Telephone (Voice): (empty)
- Telephone (Fax): (empty)
- Priority: 0
- Status: Active
- Default Server: (empty)
- Authority Name: READONLY
- Password: (empty)
- Forward To: (empty)
- Forward Name: (empty)
- Electronic Mail Address: 8001234567@vtext.com
- Comments: (empty)

Buttons at the bottom: Find, Telephony..., Owner..., OK, Cancel, Delete, Help.

Something that might be interesting to notice here is that you only need a single network record (MAIL) in networks.dat to use to route any message via the public Internet to its destination. All of the information that PageMate needs to route an SMTP message to its destination on the public Internet is provided by the Electronic Mail Address in the subscriber record. Furthermore, this is true in both GLOBAL and LOCAL modes when the referenced Pager Network is MAIL.

SMTP Authentication

In Enhanced or Extended SMTP (ESMTP) environments, SMTP Authentication, officially abbreviated SMTP-AUTH, supports an access control mechanism through which an SMTP client or dispatch MTA is required to identify itself to an SMTP server using either a username and password or a challenge/response mechanism based on a username and shared secret. Authentication methods supported in GLOBAL mode in PageMate V3.3 include PLAIN, LOGIN and CRAM-MD5.

In PLAIN and LOGIN methods, an SMTP client (PageMate) identifies itself to a server by sending a username and password. The username and password are sent as BASE64 encoded (rather than plain) text, but can still be decoded easily by an eavesdropper. CRAM-MD5, the preferred method for authentication, uses a challenge/response mechanism combined with a cryptographic Message Digest 5 algorithm to encrypt its information. Authentication can be enabled on a per-network basis in PageMate V3.3 by specifying an authentication method, username and shared secret (password) via the PageMate networks catalog (networks.dat).

Authentication is an SMTP service extension that conforms to RFC 4954 and provides a level of confidence to an SMTP server about the identity of a submitting SMTP client. But authentication is not privacy. The option to use authentication in PageMate V3.3 does not TLS-encrypt the message transmission and does not provide end-to-end privacy in the exchange between an SMTP client and server.

Limiting Message Volume

PageMate provides capabilities for limiting the number of messages that can be submitted to the same subscriber, pager or device within one-minute and ten-minute time windows.

PageMate is often used as a message delivery agent in conjunction with plant, network and environmental monitors, process automation systems and other systems and applications that can generate unpredictable message volume. Some of those source systems and applications can, under certain conditions, generate messages that are hopelessly (and often uselessly) redundant. Once you have been informed that a monitoring system has detected a temporary interruption in network connectivity in a network with a few thousand nodes, it probably won't mean much to you to get individual messages bearing the same or similar content from each of the 2,347 nodes in the network. Nevertheless, because your network monitoring system may feel that it is important to let you know, it may submit several thousand messages to the same pager within the space of a few seconds.

PageMate provides a capability for limiting the number of messages that can be submitted to the same subscriber or pager within one-minute and ten-minute time windows, and enabling this option may be able to save you from having to deal with an inordinate number of useless messages clogging your message queue. At the outset, it is important to note here that PageMate's message volume limit option only counts messages. It does not interpret message content, and therefore does not attempt to make any judgment about whether or not the body of one message is identical or substantially similar to the body of another.

Message volume limiting is enabled by setting the `LIMIT_PAGER_VOLUME` site-specific parameter to `TRUE`, and then specifying non-zero volume limits in either or both `LIMIT_1_MINUTE` and `LIMIT_10_MINUTE` parameters.

`LIMIT_1_MINUTE`, if greater than zero, specifies the maximum number of messages that PageMate will accept for the same subscriber (pager, cell phone or message destination) within any 1-minute interval. If `LIMIT_PAGER_VOLUME` is `TRUE` and `LIMIT_1_MINUTE` is set to 10, for example, then any message for any subscriber that is submitted to the PageMate Queue Server within a one-minute time window in which there have already been 10 messages enqueued for

the same subscriber, will be refused by the Queue Server. The message will not be enqueued, but will be returned to the client with a failure status.

Similarly, when `LIMIT_PAGER_VOLUME` is enabled, `LIMIT_10_MINUTE`, if greater than zero, specifies the maximum number of messages that PageMate will accept for the same subscriber within a 10-minute interval. In each case, the time interval on which PageMate's judgment is based is a "sliding time window" and is subscriber-specific.

The default value for `LIMIT_PAGER_VOLUME` is `FALSE`, and the default values for `LIMIT_1_MINUTE` and `LIMIT_10_MINUTE` are zero. A judgment about whether or not to enable `LIMIT_PAGER_VOLUME`, and which limit to use, should reflect a specific objective. If you have an objective to eliminate bursts of messages from a single source, we recommend using `LIMIT_1_MINUTE` alone with a value of 10 or less. A 10-minute interval is relatively coarse and runs a risk of eliminating important messages that arrive several minutes after a burst of relatively redundant or unimportant messages.

Controlling Access

PageMate provides capabilities for limiting access to program functionality in a variety of ways.

Most PageMate sites have an interest in limiting or controlling access to the kinds of operations we describe as administrative functionality. These are things like capabilities to manage the PageMate central catalog, inspect and flush the message queue, and view or report message history. Some sites have a need to divide or distribute these capabilities on a department, group or other functional basis. Some sites prefer to let subscribers manage their own catalog records, while others prefer to centralize or more tightly control this functionality. PageMate provides support for controlling access to catalogs and administrative functionality through configuration options and site-specific parameters defined on PageMate Server systems.

Client-Server Architecture

PageMate is a catalog-based client-server software product that presents program functionality to interactive users in either one (or both) of two ways, depending on server variant and configuration options.

In all configurations of both PageMate Classic Server and PageMate Automated Messenger (PAM) Server, a PageMate Administrator native GUI is provided to support administrative functionality (*e.g.*, managing the PageMate central catalog and message queue) through an application that presents an interactive display based on the graphic window system that is native on the server platform. The PageMate Administrator native GUI must be run on and from the PageMate Server system. In PAM Server configurations that include the PageMate Web Connector option, most of the functionality of the PageMate Administrator native GUI is duplicated in a web-based interface that can be run from any system in the network that supports a web browser. The way that access to administrator functionality is controlled in the native GUI is, not surprisingly, different from the way access is controlled in the web interface.

PageMate Administrator Native GUI

Access to administrative functionality provided under the PageMate Administrator native GUI is controlled by restricting program operation to users that qualify as administrators. On the basis of the username associated with an interactive process, users can qualify as administrators in any one of a variety of ways, including

- ✓ having logged in under a username that the operating system recognizes as being associated with an administrator account,
- ✓ having logged in under username “PageMate”, or
- ✓ having logged in under a username that has been designated as a site-specific administrator account in lieu of username “PageMate”.

The first two of these options are automatic and require no special action or configuration to set up. If, to exercise the third option, you want to designate a specific username in lieu of username “PageMate”, the specific alternate username must be specified via the site-specific PageMate ADMIN_USERNAME parameter in the Registry (on Windows) or pagemate_defaults.dat file (on Unix or OpenVMS).

If an interactive user attempts to run the PageMate Administrator native GUI and fails to qualify as an administrator on the basis of the current process login username, a PageMate-specific username/password dialog will be displayed to provide one more way the user can qualify as a PageMate administrator. If the user responds to this dialog by providing a valid PageMate subscriber name and password (as defined in the PageMate central catalog), and if the subscriber record has Administrator authority, the user will be granted access to the PageMate Administrator native GUI.

PageMate Web Client

In PAM Server configurations that include support for the PageMate Web Connector, a web client is provided in a web site installed as a part of PageMate Server. PAM Server requires a Microsoft Windows server environment. Microsoft IIS (Internet Information Server) is required as a prerequisite for the PageMate Web Connector.

Access to the PageMate Web Client is controlled through a login web dialog that requires the user to provide a PageMate subscriber name and password. When a user enters a valid subscriber name and password (as defined in the PageMate central catalog), the user is granted access to functionality under the interface based on the Authority parameter associated with user’s subscriber catalog record.

Authority parameters control access to catalog records, the PageMate message queue, message history and other functionality under the web interface. Categories of Authority include READONLY, OWN, CREATE, OPERATOR and ADMINISTRATOR, as further described in the PageMate User's Guide.

PageMate Catalogs

Most PageMate sites maintain a single, central catalog of subscriber, group and (optional) profile records. The PageMate web interface supports only central catalog operations. The PageMate Client native GUI, however, also supports an option to use client user-specific catalogs. A client user-specific catalog is a catalog of subscriber and group records that is created and maintained by an individual native client user and is accessible only to that user. The catalog is specific to the client system or workstation and to the username under which the client user logs into the system. It is essentially a user-private catalog that supplements the global or central PageMate catalog.

PageMate Client native GUI users are either permitted to or prohibited from using client user-specific catalogs based on the definition of the CLIENT_CATALOGS site-specific parameter defined on the PageMate Server that serves the client.

Message Forwarding

PageMate Automated Messenger provides capabilities for forwarding of messages from one subscriber or group to another, together with simultaneous delivery of subscriber messages to multiple devices or destinations.

Catalog records for subscribers and groups in PageMate Automated Messenger include a Forward To parameter that can be used to specify either alternate or, for subscribers, multiple delivery of messages. The Registry control parameter FORWARD_ENABLE enables message forwarding functionality both for subscribers and for groups. When FORWARD_ENABLE is TRUE, as it is by default on a PAM Server, messages submitted to groups that have a Forward To specification in the group catalog record will be delivered to the Forward To group in lieu of the original group. For subscriber records, a Forward To specification alone is not sufficient to result in message forwarding. Forwarding for subscriber records can be either in lieu of or in addition to delivery to the original recipient. The choice of which type of forwarding, as well as whether to honor the Forward To specification at all, depends on the Status parameter in the subscriber catalog record of the original recipient.

Although message forwarding is supported both for subscribers and for groups, there are differences in implementation and differences in rationale for use.

Message Forwarding for Subscribers

Message forwarding for subscribers depends not only on the presence (or absence) of a Forward To specification in the subscriber record, but also on the value of the Status parameter in the record at the time the message is dispatched. The Status parameter in a subscriber record can have any one of five values: Active (default), Forward, Copy, Inactive or Disabled. The implementation of forwarding for subscribers supports the establishment of a recipient chain.



For each recipient in this chain, based on the value of the Status parameter in each subscriber record at the time PageMate dispatches the message, PageMate will

- Dispatch the message to the current recipient only (Status=Active). The message will not be considered for dispatch to any subsequent recipients in the chain. The presence or absence of a Forward To parameter in the subscriber record will have no effect on message delivery.
- Forward the message for (conditional) dispatch to the next recipient without dispatching it to the current recipient (Status=Forward). This is the conventional and most common meaning of forwarding, forward in lieu of delivery to the current recipient.
- Dispatch the message to the current recipient, and then pass it on for (conditional) dispatch to the next recipient in the chain (Status=Copy). This is effectively “copy to” or “cc” functionality.
- Drop the message on the floor without dispatching to the current recipient or passing it on for (conditional) dispatch to any subsequent recipients in the chain (Status=Inactive and Status=Disabled). The only difference between Inactive and Disabled status is that record owners can change status from Inactive to Active, Forward or Copy, but only an Administrator can change Disabled to any other status.

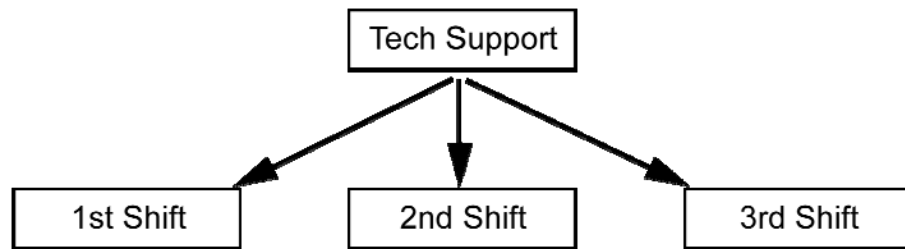
One common use for subscriber message forwarding is providing support for message delivery to multiple devices for a single subscriber. Implementing this support requires that the PageMate subscriber catalog contain separate subscriber catalog records for each device. Support for record ownership in PageMate provides a mechanism that can allow each subscriber to maintain (edit) the catalog records owned by the subscriber (based on employee number in the catalog records).

Message Forwarding for Groups

Message forwarding for groups has the conventional meaning of forward in lieu of delivery to the original recipient. Message forwarding for groups is functionally similar to subscriber message forwarding with Status=Forward, with the principal and obvious difference being that a group recipient can be any set or collection of subscribers and other groups.

The implementation of forwarding for groups can be illustrated either as a chain or as a hierarchy. Either way, messages will be forwarded until they reach an ultimate group for delivery at the end of the chain or lowest level of the hierarchy. One use for group message forwarding is providing a way to “switch” the delivery of messages from one set of recipients to another based on some business criteria like time of day or factory shift.

One way to illustrate switching or handing off message delivery based on working shift for technical support personnel is shown below.



In this illustration, a parent or master group named Tech Support forwards its messages to one of three other groups based on working shift. The same result could be obtained through a chain relationship, but in either case there will always be one and only one ultimate recipient group.

It may be helpful to remember that a group can be a single subscriber recipient or any combination of subscribers and other groups. A group cannot be a member of itself, but it may include other groups in which it is a member, and subscribers may be members of any number of groups. When PageMate dispatches a message to a group, the recipient list for the message is reduced to individual subscriber recipients with duplications removed before being dispatched.

Note

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MOTOTRBO Text Messaging

PageMate provides capabilities for sending text messages, up to 140 characters in length, to MOTOTRBO radios and groups.

PageMate support for MOTOTRBO Text Messaging Protocol (MTMP) mirrors the operation of all other protocols with a few changes in nomenclature. Whereas TAP, WCTP, SNPP and similar protocols address devices using pager numbers or phone numbers, MTMP addresses radios using radio and group IDs. Both individual MOTOTRBO radios and groups are defined using subscriber records in the PageMate catalog. PageMate also supports groups, but a PageMate group, as further discussed below, is not the same as a MOTOTRBO group.

PageMate Automated Messenger (PAM) Server dispatches MTMP messages via UDP over IP via a USB cable connection to a MOTOTRBO base station radio, typically an XPR4550 that routes messages as digital data over the air to other MOTOTRBO radios. The PageMate network catalog must include at least one record specifying a network path for messages addressed to individual radios. A typical network definition of this type is shown in the figure below.

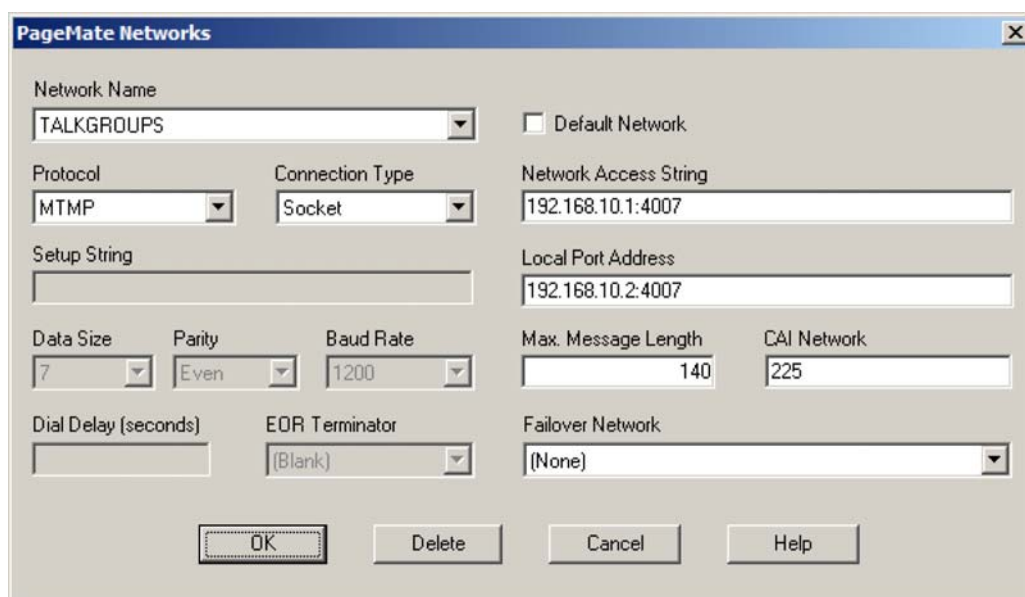
The screenshot shows the 'PageMate Networks' configuration window. It contains the following fields and controls:

- Network Name:** A dropdown menu with 'MOTORRADIOS' selected.
- Protocol:** A dropdown menu with 'MTMP' selected.
- Connection Type:** A dropdown menu with 'Socket' selected.
- Default Network:** An unchecked checkbox.
- Network Access String:** A text field containing '192.168.10.1:4007'.
- Setup String:** An empty text field.
- Local Port Address:** A text field containing '192.168.10.2:4007'.
- Data Size:** A dropdown menu with '7' selected.
- Parity:** A dropdown menu with 'Even' selected.
- Baud Rate:** A dropdown menu with '1200' selected.
- Max. Message Length:** A text field containing '140'.
- CAI Network:** A text field containing '12'.
- Dial Delay (seconds):** An empty text field.
- EOR Terminator:** A dropdown menu with '(Blank)' selected.
- Failover Network:** A dropdown menu with '(None)' selected.

At the bottom of the window are four buttons: 'OK', 'Delete', 'Cancel', and 'Help'.

In the figure above, Network Access String specifies the IP address of the base station radio on the MOTOTRBO UDP over IP network. Local Port Address specifies the IP address of the PAM Server on the MOTOTRBO UDP over IP network. CAI Network is the MOTOTRBO designated Common Air Interface that supports addressing individual radios over the air.

Because MOTOTRBO groups use a different Common Air Interface, a separate definition is required in the PageMate networks catalog for messages that will be addressed to MOTOTRBO groups. Other than having a different Network Name, the only parameter that must be different in a group network record is the CAI Network designation. In most cases, MOTOTRBO groups will use CAI Network 225.



Text messages can be submitted to PageMate using any of the supported client interfaces, including native GUIs on Windows, Sun Solaris, Linux and OpenVMS, interactive web GUIs, command line interface, and application program interface. Messages must be addressed to subscriber or group names defined in the PageMate catalog.

In PageMate terminology, a subscriber can be either an individual radio or a MOTOTRBO group. A PageMate subscriber record that specifies an MTMP network will be delivered either to an individual radio or to a MOTOTRBO group, depending on the combination of network name and the radio or group ID specified in the PIN field of the subscriber record. A PageMate group is a name that denotes a set or collection of PageMate subscribers (any mixture of individual MOTOTRBO radios and MOTOTRBO groups) that can be addressed at once by a single name.

A PageMate subscriber catalog record that identifies an individual radio should specify a Subscriber Name that matches the radio's alias in the MOTOTRBO fleetmap, a Pager Network that supports individual radio addressing (*e.g.*, a CAI 12 network), and a PIN that matches the Radio ID of the individual radio.

Similarly, a PageMate subscriber catalog record that identifies a MOTOTRBO group should specify a Subscriber Name that matches the group's alias in the fleetmap, a Pager Network that supports group addressing (*e.g.*, a CAI 225 network), and a PIN that matches the Group ID of the MOTOTRBO group.

An example subscriber catalog record for an individual MOTOTRBO radio is shown in the figure immediately below.

The screenshot shows a dialog box titled "PageMate Subscriber" with the following fields and values:

Subscriber Name	User Registration Name	
PORTABLE_5	XPR6550 Radio ID 5	
Employee Number	Company Department	
Pager Network	Type	PIN
MOTORRADIOS	Text	5
Telephone (Voice)	Telephone (Fax)	Priority
		0
		Status
		Active
Default Server	Authority Name	Password
	READONLY	
Forward To	Forward Name	
Electronic Mail Address		
Comments		

Buttons at the bottom: Find, Telephony..., Owner..., OK, Cancel, Delete, Help.

For best performance, a PAM Server that uses only MTMP networks should operate with OPTIMIZATION set to NONE.